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**AQUATIC INVERTEBRATES AND HABITAT AT A FIXED  
STATION ON THE YELLOWSTONE RIVER,  
RICHLAND COUNTY, MONTANA**

September 16, 2001

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**A report to  
the Montana Department of Environmental Quality  
Helena, Montana**

**by  
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May 2002**

## INTRODUCTION

This report is one of 38 brief interpretive summaries of data assembled as part of a statewide, multi-year study conducted by the Montana Department of Environmental Quality (MT DEQ). Each report discusses information generated from a single benthic invertebrate sample collection and habitat evaluation at a fixed station established on a gauged river or high-order tributary. The present treatise focuses on the aquatic community sampled on the Yellowstone River at Sidney, Montana on September 16, 2001. The sample site was located by GPS reading at 47° 40' 25" N, 104° 09' 27" W, lying within the Northwestern Glaciated Plains Ecoregion (Woods et al. 1998). The sample was collected by personnel of MT DEQ. Sampling effort consisted of either a composite of four Hess samples, or a one-minute kicknet collection (Bukantis 1998). Habitat parameters were evaluated using the MT DEQ Macroinvertebrate Habitat Assessment Field Form for streams with riffle/run prevalence. Invertebrate samples were processed and animals identified by Rhithron Associates, Inc. Analysis of invertebrate assemblages was accomplished by applying the method recommended by Bukantis (1998) for streams of Montana's Plains ecoregions. The method uses a multimetric battery to evaluate disturbance to biotic integrity. Results from the application of other metric batteries may be found in the Appendix.

## RESULTS AND DISCUSSION

Table 1 itemizes the evaluated habitat parameters and shows the assigned scores for each, as well as the integrated score and condition category.

Overall habitat conditions scored marginally at this site on the Yellowstone River. The field evaluator described the site thus: "Good flow but very turbid. There is lots of sediment. It looks like a recent event... Water appears to be low." Poor riffle development was perceived, and some monotony of the benthic substrate was reported. Sediment deposition was accorded a marginal score. Streambanks were judged moderately stable. The riparian zone width was abbreviated on both sides of the channel.

**Table 1.** Stream and riparian habitat assessment for a fixed station on the Yellowstone River, September, 2001.

| Max. possible score | Parameter                        | Yellowstone River at Sidney  |
|---------------------|----------------------------------|------------------------------|
| 10                  | Riffle development               | 2                            |
| 10                  | Benthic substrate                | 6                            |
| 20                  | Embeddedness                     | 11                           |
| 20                  | Channel alteration               | 11                           |
| 20                  | Sediment deposition              | 6                            |
| 20                  | Channel flow status              | 7                            |
| 20                  | Bank stability: left / right     | 6 / 6                        |
| 20                  | Bank vegetation: left / right    | 6 / 6                        |
| 20                  | Vegetated zone: left / right     | 7 / 6                        |
| 160                 | Total                            | 80                           |
|                     | Percent of maximum<br>CONDITION* | <b>50</b><br><b>MARGINAL</b> |

\*Condition categories: Optimal (OPT) > 80% of maximum score; Sub-optimal (SUB); 75 - 56%; Marginal (MARG) 49 - 29%; Poor <23%. Adapted from Plafkin et al. 1998.

**Table 2.** Metric values, scores, and bioassessment for a fixed station on the Yellowstone River. The Montana DEQ bioassessment metric battery recommended for streams of the Plains ecoregions (Bukantis 1998) was used for the evaluation. September 2001.

|                          | Yellowstone River at Sidney      |                      |
|--------------------------|----------------------------------|----------------------|
| <b>METRICS</b>           | <b>METRIC VALUES</b>             | <b>METRIC SCORES</b> |
| Taxa richness            | 18                               | 2                    |
| EPT richness             | 2                                | 0                    |
| Biotic index             | 6.85                             | 1                    |
| % Dominant taxon         | 32.52                            | 2                    |
| % Collectors             | 80.37                            | 1                    |
| % EPT                    | 7.36                             | 0                    |
| Shannon diversity        | 3.07                             | 3                    |
| % Scrapers and Shredders | 1.84                             | 0                    |
| Predator taxa            | 5                                | 2                    |
| % Multivoltine           | 42.48                            | 2                    |
|                          | <b>TOTAL SCORE</b><br>(max.=30)  | 13                   |
|                          | <b>PERCENT OF</b><br><b>MAX.</b> | 43                   |
|                          | Impairment<br>classification     | <b>MODERATE</b>      |
|                          | USE SUPPORT                      | <b>PARTIAL</b>       |

Bioassessment results are given in Table 2. When this bioassessment method is applied to these data, scores indicate that this site on the Yellowstone River is moderately impaired and only partially supports designated uses. However, low abundance of organisms in the sample complicates the evaluation; conclusions and interpretation of results are tenuous. Whether the inadequacy of the sample was due to a depauperate community at the site or to sampling bias is not clear from the data itself, but the habitat evaluation suggests that the former explanation may in fact be the correct one.

Nearly half of the animals collected in this sample were midges; the only other groups represented in abundance were a few taxa of tolerant dipterans. This skew in the taxonomic composition of the assemblage suggests that monotonous soft substrates severely limited the benthic community. Only 4 "clinger" taxa were present, indicating that hard substrate surfaces unimpaired by fine sediment deposition were lacking.

Filter-feeders and gatherers dominated the functional structure of the assemblage. Scrapers were nearly non-existent at the site; this may have been attributable to the turbid water and lack of hard benthic substrate.

Water quality indicators are difficult to interpret for this assemblage; the biotic index value (6.85) was elevated, and the few mayflies present at the site were in 2 taxa. These findings suggest that nutrient enrichment may have been a factor in limiting biotic health. However, the disturbance to habitat that resulted in turbidity and sediment deposition were likely the overwhelming factors influencing the biota at this site.

## CONCLUSIONS

- Low abundance of organisms in the sample complicates assessment of the site based on invertebrate assemblages; however, severe impairment due to sediment deposition likely accounts for the depauperate sample, the taxonomic structure of the collected assemblage, and their tolerance characteristics.
- The bioassessment method employed seems to have exaggerated the quality of the benthic fauna to some degree. Based on the taxonomic composition of the sampled assemblage, impairment at this site appears to be severe.

## LITERATURE CITED

Bukantis, R. 1998. Rapid bioassessment macroinvertebrate protocols: Sampling and sample analysis SOP's. Working draft. April 22, 1997. Montana Department of Environmental Quality. Planning Prevention and Assistance Division. Helena, Montana.

Woods, A.J., Omernik, J. M. Nesser, J.A., Sheldon, J., and Azevedo, S. H. 1999. Ecoregions of Montana. (Color poster with map, descriptive text, summary tables, and photographs) Reston, Virginia. US Geological Survey.

## **APPENDIX**

**Taxonomic data and summaries**

**Yellowstone River**

**September 2001**

# Aquatic Invertebrate Taxonomic Data

Site Name: Yellowstone River at Sidney

Date: 9/16/01

Site ID: Y23YELLR01

Approx. percent of sample used 100

| Taxon                           | Quantity   | Percent       | HBI | FFG |
|---------------------------------|------------|---------------|-----|-----|
| Nematoda                        | 1          | 0.61          | 11  | PA  |
| <i>Limnodrilus hoffmeisteri</i> | 12         | 7.36          | 10  | CG  |
| <i>Hyalella azteca</i>          | 1          | 0.61          | 8   | CG  |
| <b>Total Misc. Taxa</b>         | <b>14</b>  | <b>8.59</b>   |     |     |
| <i>Centroptilum</i> sp.         | 10         | 6.13          | 2   | CG  |
| <i>Heptagenia</i> sp.           | 2          | 1.23          | 4   | SC  |
| <b>Total Ephemeroptera</b>      | <b>12</b>  | <b>7.36</b>   |     |     |
| Corixidae - immature            | 18         | 11.04         | 10  | UN  |
| <i>Trichocorixa borealis</i>    | 1          | 0.61          | 10  | PR  |
| <b>Total Hemiptera</b>          | <b>19</b>  | <b>11.66</b>  |     |     |
| Enochrus                        | 1          | 0.61          | 5   | PR  |
| <b>Total Coleoptera</b>         | <b>1</b>   | <b>0.61</b>   |     |     |
| Ceratopogoninae                 | 2          | 1.23          | 6   | PR  |
| Dolichopodidae                  | 3          | 1.84          | 4   | PR  |
| <i>Limnophora</i> sp.           | 3          | 1.84          | 6   | PR  |
| <i>Erioptera</i> sp.            | 28         | 17.18         | 7   | CG  |
| <b>Total Diptera</b>            | <b>36</b>  | <b>22.09</b>  |     |     |
| <i>Ablabesmyia</i> sp.          | 1          | 0.61          | 8   | CG  |
| <i>Chironomus</i> sp.           | 7          | 4.29          | 10  | CG  |
| <i>Cricotopus Bicinctus</i> Gr. | 1          | 0.61          | 7   | CG  |
| <i>Polypedilum</i> sp.          | 1          | 0.61          | 6   | SH  |
| <i>Rheotanytarsus</i> sp.       | 53         | 32.52         | 6   | CF  |
| <i>Tanytarsus</i> sp.           | 18         | 11.04         | 6   | CF  |
| <b>Total Chironomidae</b>       | <b>81</b>  | <b>49.69</b>  |     |     |
| <b>Grand Total</b>              | <b>163</b> | <b>100.00</b> |     |     |

# Aquatic Invertebrate Summary

Site Name: Yellowstone River at Sidney

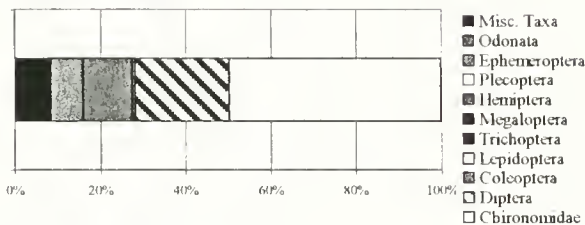
Date: 9/16/01

SAMPLE TOTAL 163

EPT abundance 12  
TAXA RICHNESS 18  
Number EPT taxa 2  
Percent EPT 7.36

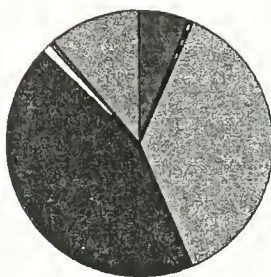
## TAXONOMIC COMPOSITION

| GROUP         | PERCENT | #TAXA | ABUNDANCE |
|---------------|---------|-------|-----------|
| Misc. Taxa    | 8.59    | 3     | 14        |
| Odonata       | 0.00    | 0     | 0         |
| Ephemeroptera | 7.36    | 2     | 12        |
| Plecoptera    | 0.00    | 0     | 0         |
| Hemiptera     | 11.66   | 2     | 19        |
| Megaloptera   | 0.00    | 0     | 0         |
| Trichoptera   | 0.00    | 0     | 0         |
| Lepidoptera   | 0.00    | 0     | 0         |
| Coleoptera    | 0.61    | 1     | 1         |
| Diptera       | 22.09   | 4     | 36        |
| Chironomidae  | 49.69   | 6     | 81        |



## FUNCTIONAL COMPOSITION

| GROUP     | PERCENT | #TAXA | ABUNDANCE |
|-----------|---------|-------|-----------|
| Predator  | 6.13    | 5     | 10        |
| Parasite  | 0.61    | 1     | 1         |
| Gatherer  | 36.81   | 7     | 60        |
| Filterer  | 43.56   | 2     | 71        |
| Herbivore | 0.00    | 0     | 0         |
| Piercer   | 0.00    | 0     | 0         |
| Scraper   | 1.23    | 1     | 2         |
| Shredder  | 0.61    | 1     | 1         |
| Xylophage | 0.00    | 0     | 0         |
| Omnivore  | 0.00    | 0     | 0         |
| Unknown   | 11.04   | 1     | 18        |



## COMMUNITY TOLERANCES

|                                  |      |
|----------------------------------|------|
| Sediment tolerant taxa           | 1    |
| Percent sediment tolerant        | 7.36 |
| Sediment sensitive taxa          | 0    |
| Percent sediment sensitive       | 0.00 |
| Metals tolerance index (McGuire) | 2.77 |
| Cold stenotherm taxa             | 0    |
| Percent cold stenotherms         | 0.00 |

Site ID: Y23VELL01

## DOMINANCE

| TAXON                           | ABUNDANCE | PERCENT |
|---------------------------------|-----------|---------|
| <i>Rheotanytarsus</i> sp        | 53        | 32.52   |
| <i>Erioptera</i> sp             | 28        | 17.18   |
| Corixidae - immature            | 18        | 11.04   |
| <i>Tanytarsus</i> sp            | 18        | 11.04   |
| <i>Limnodrilus hoffmeisteri</i> | 12        | 7.36    |
| SUBTOTAL 5 DOMINANTS            | 129       | 79.14   |
| <i>Centroptilum</i> sp          | 10        | 6.13    |
| <i>Chironomus</i> sp            | 7         | 4.29    |
| Dolichopodidae                  | 3         | 1.84    |
| <i>Limnophora</i> sp            | 3         | 1.84    |
| <i>Heptagenia</i> sp            | 2         | 1.23    |
| TOTAL DOMINANTS                 | 154       | 94.48   |

## SAPROBITY

|                         |      |
|-------------------------|------|
| Hilsenhoff Biotic Index | 6.85 |
|-------------------------|------|

## DIVERSITY

|                  |      |
|------------------|------|
| Shannon H (loge) | 2.13 |
| Shannon H (log2) | 3.07 |
| Simpson D        | 0.17 |

## VOLTINISM

| TYPE         | ABUNDANCE | PERCENT |
|--------------|-----------|---------|
| Multivoltine | 69        | 42.48   |
| Univoltine   | 93        | 56.90   |
| Semivoltine  | 1         | 0.61    |

## TAXA CHARACTERS

|            | #TAXA | ABUNDANCE | PERCENT |
|------------|-------|-----------|---------|
| Tolerant   | 5     | 24        | 14.72   |
| Intolerant | 0     | 0         | 0.00    |
| Clinger    | 4     | 22        | 13.50   |

## BIOASSESSMENT INDICES

| B-IBI (Karr et al.) |       |       |      |
|---------------------|-------|-------|------|
| METRIC              | VALUE | SCORE |      |
| Taxa richness       | 18    | 1     |      |
| E richness          | 2     | 1     |      |
| P richness          | 0     | 1     |      |
| T richness          | 0     | 1     |      |
| Long-lived          | 0     | 1     |      |
| Sensitive richness  | 0     | 1     |      |
| %tolerant           | 14.72 | 5     |      |
| %predators          | 6.13  | 1     |      |
| Clinger richness    | 4     | 1     |      |
| %dominance (3)      | 60.74 | 3     |      |
| TOTAL SCORE         |       | 16    | 32 % |

## MONTANA DEQ METRICS (Bukantis 1998)

| METRIC             | VALUE | Plains Ecoregions | Valleys and Foothills | Mountain Ecoregions |
|--------------------|-------|-------------------|-----------------------|---------------------|
| Taxa richness      | 18    | 2                 | 1                     | 0                   |
| EPT richness       | 2     | 0                 | 0                     | 0                   |
| Biotic Index       | 6.85  | 1                 | 0                     | 0                   |
| %Dominant taxon    | 32.52 | 2                 | 2                     | 2                   |
| %Collectors        | 80.37 | 1                 | 1                     | 0                   |
| %EPT               | 7.36  | 0                 | 0                     | 0                   |
| Shannon Diversity  | 3.07  | 3                 |                       |                     |
| %Scrapers + Shredd | 1.84  | 0                 | 0                     | 0                   |
| Predator taxa      | 5     | 2                 |                       |                     |
| %Multivoltine      | 42.48 | 2                 |                       |                     |
| %H of T            | 0     |                   | 3                     |                     |
| TOTAL SCORES       |       | 13                | 7                     | 2                   |
| PERCENT OF MAXIMUM |       | 43.33             | 29.17                 | 9.52                |
| IMPAIRMENT CLASS   |       | MODERATE          | MODERATE              | SEVERE              |

## Montana DEQ metric batteries

